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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/625,490 | 07/22/2003 | A. Farid Issaq | ACT-377 | 9116 |

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| EXAMINER | |
|---|---|
| TRAN, THIEN F | |
| ART UNIT | PAPER NUMBER |
| 2811 | |

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
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| 3 MONTHS | 01/08/2007 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/625,490 | ISSAQ ET AL. | |
| | Examiner | Art Unit | |
| | Thien F. Tran | 2811 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *31 October 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *11-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *11-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Election/Restrictions*

Applicant's election without traverse of the species 5 of Fig. 3A with claims 11-19 readable on the elected species in the reply filed on 10/31/2006 is acknowledged.

### *Claim Objections*

Claim 11 is objected to because of the following informalities: "said first insulating layer" should be corrected for lack of antecedent basis. Appropriate correction is required.

### *Claim Rejections - 35 USC § 112*

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 11-19 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The recitation of a first layer of a barrier metal disposed above and in electrical contact with said tungsten plug in claim 11 sets forth a structure not supported by the elected species 5 illustrated in Fig. 3A. Applicant is requested to point out exactly wherein the application with respect to the elected species 5 (Fig. 3A) that shows or discloses a first layer of a barrier metal disposed above and in electrical contact with said tungsten plug as recited in claim 11. In fact,

the elected Fig. 3A shows only one layer (24) of a barrier metal disposed over said antifuse layer (22) which corresponds to the second layer of a barrier metal recited in claim 11. Fig. 3A does not show a first layer of a barrier metal disposed above and in electrical contact with the tungsten plug as claimed in claim 11. It appears the claim language is inconsistent with what is being described in the application with respect to the elected species 5 of Fig. 3A.

The recitation of a spacer disposed in physical contact with said antifuse layer, said first layer of said barrier metal, and said second layer of said barrier metal in claim 13 sets forth a structure not supported by the elected species 5 of Fig. 3A. Fig. 3A does not show a spacer as claimed.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 11-15 and 17-18, insofar as in compliance with 35 USC 112, are rejected under 35 U.S.C. 103(a) as being unpatentable over Hawley et al (US 6,437,365) in view of Jain et al (US 6,107,165) and Gangopadhyay (US 6,114,714).

Regarding claims 11, 12, 17 and 18, Hawley et al teach a metal-to-metal antifuse comprising (Fig 6):

a tungsten plug (18) disposed in a via in an insulating layer (16) disposed above and in electrical contact with a lower metal interconnection layer (14); a first layer of a

barrier metal (42) disposed above and in electrical contact with said tungsten plug forming a first electrode, said first layer of said barrier metal comprising a titanium nitride (TIN); an antifuse layer (20) disposed above an upper surface of said tungsten plug, said antifuse layer comprising a lower SiN layer (22) a middle layer (24) comprising amorphous silicon, and an upper SiN layer (26); and a second layer of a barrier metal (30) disposed over said antifuse layer forming a second electrode, said second layer of said barrier metal comprising a titanium nitride; and a second insulating layer of oxide layer (52) disposed over said first insulating layer (16), said antifuse layer, said first layer of said barrier metal, and said second layer of said barrier metal.

Hawley et al. do not teach that the first and second layers of a barrier metal comprising tantalum nitride. Jain et al. teach titanium nitride and tantalum nitride can be used for barrier metal (col. 4, line 66 - col. 5, line 3). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the titanium nitride of Hawley with tantalum nitride as taught by Jain since titanium nitride and tantalum nitride are art recognized barrier metal material.

Hawley et al. in view of Jain do not teach the middle layer (24) comprising hydrogen doped amorphous carbon. Gangopadhyay teaches a hydrogen doped amorphous carbon used for antifuse material (2, Fig.1A). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute amorphous silicon with hydrogen doped amorphous carbon since amorphous carbon could reduce ON-OFF switching and leakage current.

Hawley, Jain and Gangopadhyay disclose the same structure as claimed but do not explicitly teach that the SiN layers (22 & 26) are adhesion-promoting layers. However, the adhesion-promoting layer of the present invention also comprises a SiN film; therefore, the SiN layers (22, 26) on both sides of the middle layer (24) of hydrogen doped amorphous carbon inherently function as "adhesion-promoting layer" and would meet the recited term "a lower adhesion-promoting layer" and "an upper adhesion-promoting layer".

Regarding claim 13, Hawley et al. teach antifuse further comprising a spacer (32, Fig.3) disposed in physical contact with said antifuse layer, said first layer of said barrier metal, and second layer of said barrier metal.

Regarding claim 14, Hawley et al. teach said antifuse layer having a thickness of 61 nm (col. 4, lines 29-32).

Regarding claim 15, Hawley et al. teach the first and second barrier metal having a thickness of 200 nm (col. 4, lines 5-9 & col. 6, lines 26-30).

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hawley, Jain, and Gangopadhyay, as applied to claim 11 above, and further in view of Han et al. (US 6,583,953).

Hawley et al. do not teach SiC used as a adhesion-promoting layer for the carbon. Han et al. teach in Fig.4, a SiC interlayer (60) forms as an adhesion layer for Carbon layer (66). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select SiC instead of SiN as an adhesion layer

that would have improved adhesive properties over conventional silicon-based adhesion layers like SiN (col. 4, lines 21-24).

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hawley, Jain, and Gangopadhyay, as applied to claim 11 above, and further in view of Forouhi (US 5,181,096).

Hawley et al. do not teach a tungsten layer atop the barrier metal layer. Forouhi in Fig.1 teaches a tungsten layer (30) formed on the barrier metal (28). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching Forouhi with Hawley in order to produce a device with a process compatible electrode.

***Response to Arguments***

Applicant's arguments filed 02/13/2006 have been fully considered but they are not persuasive. Applicant asserts that SiN functions as an adhesion layer for amorphous silicon does not imply that it would function as an adhesion layer for amorphous carbon. The examiner respectfully disagrees with the remark. The claim limitation "adhesion-promoting layer" is a functional language and is non-limiting since it has been held that claims directed to apparatus must be distinguished from the prior art in terms of structure rather function. In re Danley, 120 USPQ 528, 531 (CCPA 1959). "Apparatus claims cover what a device is, not what a device does." Hewlett Packard Co. v. Bausch & Lomb Inc., 15 USPQ2d 1525, 1528 (Fed. Cir. 1990). A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the

prior art apparatus teaches all the structure limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). Furthermore, the combined teachings of Hawley, Jain, and Gangopadhyay disclose the same structure as claimed, thus it would have been obvious that SiN layers (22, 26) formed under and above the middle layer (24) of amorphous carbon inherently perform the same function as an adhesion-promoting layer. It is clear that the claimed structure in the present invention is not patentable distinguished from the prior art structure because the present invention also uses the same SiN layer disclosed by Hawley as an adhesion layer. It is noted that Applicant's Declaration does not provide any convincing scientific evidence (data, graph) to support his contention that the subject matter shown to be in the prior art does not possess the characteristics relied on. Applicant's argument alone cannot take the place of evidence in the record.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., using a current of only about 1 mA) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the

specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thien F. Tran whose telephone number is (571) 272-1665. The examiner can normally be reached on 8:30AM - 5:00PM Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on (571) 272-1869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Thien F Tran
Primary Examiner
Art Unit 2811

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December 27, 2006